A 21st-Century Perspective on the "Socialist-Calculation Debate" re: Economic Planning

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The story of the Socialist-Calculation Debate is an unputdownable chapter of the history of economic theorizing in the 20th century. It lasted from 1920 until 1967. It was precipitated by Otto Neurath's suggestion in 1919 that a centrally planned national economy could function quite well with no use at all of monetary currency, and could thus be ecologically shipshape. It ended with Oskar Lange's correct prediction that modern computers would be able to provide quick solutions to vast sets of simultaneous linear equations.[1] These were politically pro-socialism arguments; the best right-wing argument in the debate was written in 1945 by Friedrich Hayek and was rewarded with half of the Swedish Riksbank's 1974 Prize in Economic Sciences in Honor of Alfred Nobel.[2]

The debate began when Ludwig von Mises responded in 1920 to Neurath's arguments on behalf of Communist economic planning.[3] Von Mises said that socialism could never be economically efficient, because if government were to own or to control the means of production (this was for him the defining hallmark of socialism), rational evaluation of capital goods (as distinct from consumer-goods) would become impossible: "Since the [capital] goods would not be priced [in units of a national currency], planners would be unable to allocate them efficiently" and therefore, "rational economic activity is impossible in a socialist commonwealth" – whereas a (theoretical) free market would show, via its pricing, how to distribute all kinds of resources rationally since people selling in markets distribute goods and services on the basis of purchasors' willingness to pay money for them.

Max Weber and Lionel Robbins (the head of the London School of Economics) favored the anti-socialism side of the debate; Hayek developed that side of it by describing the monetary price system under capitalism as an information-processing scheme for which no adequate substitute could ever be devised. Lange, Abba Lerner and H.D. Dickinson were on the socialists' side. Neurath also participated, but almost entirely in private discussions rather than in public debate. This essay will describe some of his and Lange's relatively unfamiliar arguments and put them in detailed historical context.

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Otto Neurath (1882-1945) was trained as an economist and became active also as a philosopher and graphic designer. His experiences working for the Austro-Hungarian government during World War I by helping organize its wartime economic planning persuaded him that socialist planning would be feasible and desirable in peacetime. Right after the war, the Social Democratic government of Bavaria invited him to serve in Munich on a commission overseeing the administration of the Bavarian economy. But then during the 1919 revolution in Germany, the Social Democratic premier of Bavaria was assassinated by right-wing nationalists, and this led to a Communist uprising in Munich which resulted in the elected government being replaced by a "Soviet Republic of Bavaria", which retained Neurath in his post. The German army soon put down the uprising, however, and Neurath was arrested and charged with treason on account of his having served the soviet republic. He pleaded not guilty on the grounds that his duty as a civil servant had been to serve whoever was in power. Prominent German academics (including Max Weber) spoke out on his behalf, the Austrian government interceded for him, and ultimately his sentence of a year and a half of confinement to a fortress

1. An ordinary laptop computer nowadays can normally solve a million such equations in a minute.

2. The other half of the prize went to a welfare economist. This was, obviously though not explicitly in writing, a political deal.

3. The article by von Mises was entitled "*Die Wirtschaftsrechnung im sozialistischen Gemeinwesen*" (it was translated in 1935 as "Economic Calculation in the Socialist Commonwealth"), whereby "*Gemeinwesen*" means, in effect, a country whose government owns or controls the "means of production" in the national economy.

was commuted to expulsion from Germany for seven years. So he returned to his native Austria and devoted himself to the workers' movement there (by, for instance, teaching classes for workers) – and also developed graphic isotypes for conveying practical information to illiterate or semi-literate people, an invention which has had a lasting impact on graphic design internationally.[4]

Neurath was very active as a philosopher. Before the war he had been, in Vienna, part of a circle concerned with Ernst Mach's concept of science; he was one of several Austrian Marxists drawn to Mach's philosophy (or, in some cases, to neo-Kantianism) despite Vladimir Lenin's disapproval of such tendencies. In the 1920s he began to collaborate with a number of philosophers and scientists (Rudolf Carnap, Moritz Schlick, Philipp Frank *et al*.) in an effort to update Mach's ideas in light of the new developments in logic that had been pioneered by people like Gottlob Frege, Bertrand Russell and Ludwig Wittgenstein. This new philosophy became known as logical positivism or logical empiricism. Neurath co-authored with Carnap a manifesto for it, "The Scientific Conception of the World: The Vienna Circle", and was the driving force behind a unity-of-science movement seeking to join the natural and the social sciences and producing the Vienna Circle's *International Encyclopedia of Unified Science*.

Much of Neurath's discussion with Hayek as to the feasibility of "socialist calculation" hinged on their opposing stances in regard to Neurath's philosophical "physicalism". Many of the logical positivists envisaged a kind of reconstruction of science on the basis of sense-data, but Neurath regarded perceptual experiences as too subjective to provide a valid foundation for science; he thought that a stronger one could be based on mathematically formulated physics and objective spatio-temporal coordinates, and that such an approach would foster the elimination of metaphysical statements from science by enabling its propositions to be reduced to a set of assertions related to physical facts; and he held that this physicalism was applicable to the social as well as to the natural sciences. Until fairly recently, his role in the socialist-calculation debate has tended to be downplayed in literature about the debate (most likely because he communicated with Hayek by post rather than publicly). In recent years, however, research on ecological economics and sustainable development has fostered a revival of interest in some of his economic ideas because he advocated "in-kind" (as distinguished from monetary) economic accounting (*Naturalrechnung*). (In the 1920s he also advocated *Vollsozialisierung*, i.e "complete" rather than merely partial "socialization".) His proposed changes to national economic systems were therefore more radical than those advocated by the mainstream Social-Democratic parties of Germany and Austria, and he debated these matters in the '20s with leading Social-Democratic theoreticcians (such as Karl Kautsky, who insisted upon the necessity of money in a socialist economy).

It was while serving as a government economist during the war that Neurath had observed that "As a result of the war, in-kind calculation was applied more often and more systematically than before.... It was all too apparent that war was fought with ammunition and with the supply of food, not with money" – and had come to believe in the feasibility of a peacetime economic system with thorough planning done entirely in terms of quantitative amounts of specified goods and services, and thus with no need for monetary currency. It seemed to him that the wartime economy (when there was such rampantly galloping inflation that money had become unwieldy) had been characterized by speed of decision and execution, optimal distribution of means relative to (military) goals, and no-nonsense evaluation and utilization of inventiveness. Two disadvantages which he perceived as resulting from centralized decision-making were a reduction in productivity and a loss of the benefits of simple economic exchanges; but he thought (as did Lenin) that the reduction in productivity could be mitigated by means of "scientific" techniques based on analysis of work-flows etc. as advocated by Frederick Winslow Taylor (an American mechanical engineer and management-consultant). Neurath believed that socio-economic theory and scientific methods could be applied *together*. He would have central planners

4. For instance: was succeeded by ☎ and eventually by , and meanwhile, isotypes for "Men's Room", "Ladies' Room", "Baggage Deposit", "Children Playing in the Street", etc. came into use; and in due time ☺ and all the rest.

grant some degree of independence to small producers in the crafts and in agriculture; he felt that "The doctrine that there is a trend towards ever more comprehensive organizations [had] been confirmed fully, less so the doctrine that small businesses will be replaced by largescale concerns"; he considered it essential, however, that small producers of various sorts be organized in a multitude of regional and branch organizations to ensure that goods and services would be produced according to the central plan, and he held that this *Vollsozialisierung* would require a comprehensive statistical apparatus: "Even before they begin their work, all bodies ... should be required to report to the Central Economic Administration, which, in collaboration with the Center for Statistics ... will fit the individual results into the universal statistics."

When countering the theories of some of the leading Austrian champions of market-economics (Carl Menger and Joseph Schumpeter), Neurath found that he had to challenge some of their basic philosophical assumptions. From Aristotle and from socialist literature he adopted the radical notion of wealth as based on use-value and welfare, whereby economic theory would be concerned with "wealth" in the sense of people's physical and social conditions. His concept of welfare was, however, more Epicurean than Aristotelian; he said that "social Epicureanism deals with the happiness of human beings as an effect of social actions. What is the effect of different orders of life, of different measures, on the conditions of life of human beings and thereby on their happiness and unhappiness?" He felt that economists should try to find out which conditions promote people's wealth in *that* sense of the term, and which institutions increase or decrease it. But he also perceived a theoretical challenge re: representing wealth and its allocation in such terms – i.e. re: how to defend the rationality, objectivity and fairness of decision-making in his alternative framework. In considering "the problem of pleasure-maximum", he argued that cardinal measures – that is, quantitative ratings with cardinal numbers (such as, say, 481 and 25¾) as distinct from ordinal numbers (1st, 2nd, 3rd...) – for comparative utility or "pleasure values" could not be computed for any one individual, much less for different individuals. He also rejected the assumption that it is possible to sum together the utility functions (the pleasures) of separate individuals. He therefore concluded that it is not possible to calculate maximum social-utility functions, i.e., that interpersonal comparisons of utility are impossible – and likewise for comparisons of utility for the same person at different times.[5] He felt that this general absence of valid unitary measures and algorithms for decision-making weakened the theoretical case for a market economy, because he held that market-economic theory assumes a framework in which "people influence each other's actions exclusively by means of the higher and lower qualities of life that result from the process of exchange," with the main conditioning-factors being profit and loss (and with the goals being those of maximizing the one and minimizing the other). On the other hand he thought it would be a virtue of an administrated economy that it could, "by rewards and penalties, prompt individuals to do things which they would not have done in an economy characterized by exchange, because without these rewards and penalties the consequences would have been different".

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It was a quarter-century after the original exchanges between Neurath and Mises that the debate resumed – this time between Neurath and Hayek but with Neurath's part of it being kept private by Hayek's refusal to debate publicly. Neurath, upon reading in 1945 an essay by Hayek which attacked what Hayek called "scientism" and which singled out Neurath as a prime culprit, challenged Hayek to a public exchange of views. Hayek replied: "I am at the moment entirely engrossed in an attempt to elaborate the psychological implications of the earlier part of my Scientism essays – or rather an attempt to restate certain ideas I had formed on this

5. The great classical economist David Ricardo said (in Chapter 32 of his *On the Principles of Political Economy and Taxation*, 1817) that "One set of necessaries and conveniences admits of no comparison with another set; value in use [as distinct, for instance, from monetary value in market-exchange] cannot be measured by any known standard; it is differently estimated by different persons." He also said (in a letter of 6 January 1818 to James Mill) that "The difficulty of the doctrine of expediency or utility is how to balance one object of utility against another – there being no standard in nature, it must vary with the tastes, the passions and the habits of mankind." (In *The Works and Correspondence of David Ricardo* edited by Piero Sraffa and M.H. Dobb, see p.242 in vol.7.) (The internet address of a fine essay (2004, by Sergio Cremaschi) entitled "Ricardo and the Utilitarians" is https://philarchive.org/archive/CRERAT-2.)

subject a very long time ago – at the moment at any rate I feel quite unable to give my mind to anything but these questions, but, of course, nothing may come of it."[6] However, Neurath persisted with additional correspondence, and the result was a private exchange of some of their respective views.

Hayek had previously criticized what he saw as Neurath's rationalism; Neurath now responded that he was just as critical of rationalism as Hayek was and that they actually shared some assumptions as to the limits of reason and predictability. Neurath was rebutting what he saw as some misunderstandings of logical empiricism which Hayek had popularized and which were (and still are) widely accepted. Neurath attempted to turn these assumptions back against Hayek in order to defend the possibility of socialist planning. It seemed to Hayek that Neurath's belief in *in-natura* calculation was due to an illusion as to the nature of knowledge similar to the illusion of social engineers who think social problems have purely technical "optimum" solutions. Hayek thought that social engineers (including Neurath) were falling for a "Cartesian rationalism" according to which human reason would be viewed as omnipotent and that they were thus failing to perceive that knowledge, including practical knowledge in the form of local skills and know-how (Michael Polyani had called it "tacit knowledge") is dispersed in society and cannot be articulated in propositional form and gathered together by a central planning agency. Hayek, seeing in the market-price system an indispensable way of coordinating information and distributing it among different economic actors, felt that there could never be an *in-natura* alternative to this reliance on money and prices, there could never be any physical units (such as units of energy) which economic planners could successfully use to devise a uniquely "optimum" solution. However, Neurath himself rejected the notion that there are technocratically based optimum solutions to social problems; he was just as hostile towards technocratic world-be-panaceas as Hayek was; he said, however, that when it comes to social choices, no proposal can be valid unless it takes into account multiple criteria (not just monetary price) for evaluation: he shared with Hayek certain epistemic assumptions, and his critique of what he called "pseudorationalism" resembled Hayek's rejection of rational science. Neurath thought that he could, in a public debate, turn the tables on Hayek, but then he died within five months (at the age of 63), and since Hayek had rejected his proposal of a proper debate in public, quite a few issues in their truncated private discussion were left hanging in the air. According to a recent student of Neurath's philosophy,

> "The most striking area in which there is congruence between Hayek and Neurath is in their common rejection of Cartesian rationalism and the technocratic conception of planning that they both take to stem from it. Hayek's account of Neurath as an advocate of such rationalism in his scientism essay is simply in error. Moreover, there are important overlaps in their arguments against the possibility of complete predictability in the social sciences. For example, both appeal to the argument that complete prediction of the future direction of society is impossible, since social change is dependent on developments in the content of knowledge and those developments are in principle unpredictable."

The extant traces of this private debate do not show whether Neurath in the 1940s was still calling for centrally planned *Vollsozialisierung* (although they do show that Hayek took this for granted). Neurath clearly still doubted, however, that free markets could be relied upon to deal decently with issues involving non-renewable resources. It is possible to agree with Neurath on that score – and indeed this point has been taken up by modern ecological economists – without accepting his belief (at least in the 1920s) in the feasibility of an economic system so thoroughly permeated with *in-natura* calculations that money could be dispensed with.

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6. In citing this letter of Hayek's, an admiring disciple of his has pointed out that he "did not tell Neurath that his new work was aimed at least in part at Neurath's own physicalism" (see Bruce Caldwell, *Hayek's Challenge*: *An Intellectual Biography of F. A. Hayek* (2004), p.257.)

The most notable other representative of the pro-socialism side in the social-calculation debate was Oskar Lange, who was an explicit opponent of *Vollsozialisierung* in the foreseeable future.[7] Lange was a Polish economist who migrated to England in 1934 (where a Rockefeller fellowship supported him) and then served as an economics professor at the University of Chicago from 1938 to 1945, when he gave up his American citizenship and returned home to Poland. During the World War II he had worked initially for the Polish government in exile but then had broken with them to work for the Soviet-backed Lublin Committee instead. He was a Marxist *and* a neoclassical economist; he thought Marxism provided the key to understanding the historical evolution of capitalism (including its supposed ultimate displacement by socialism), but he regarded traditional Marxist economics as inadequate in several ways. He considered the "labor theory of value" (as shared to a great extent by Adam Smith and David Ricardo as well as Marx) unscientific, and held that a Marxian concept of exploitation could be restated without it:

> "If people want to anticipate the development of Capitalism over a long period, a knowledge of Marx is a much more effective starting point than a knowledge of [Friedrich von] Wieser, [Eugen von] Bohm-Bawerk, Vilfredo Pareto or even [Alfred] Marshall (although the last-named is in this respect much superior). But Marxian economics would be a poor basis for running a central bank or anticipating the effects of a change in the rate of discount."
>
> "[I]n providing a scientific basis for the current administration of the capitalist economy[,] 'bourgeois' economics has developed a theory of equilibrium which can also serve as a basis for the current administration of a socialist economy. It is obvious that Marshallian economics offers more for the current administration of the economic system of Soviet Russia than Marxian economics does, though the latter is surely the more effective basis for anticipating the future of capitalism."

Lange appreciated Marshall for taking seriously the fact that the theoretical concept of "perfect competition" is unrealistic. Keynes was also among the non-Marxian economists whom he regarded as very informative about the dynamics of capitalism. Lange held, however, that von Mises's original argument floundered on a confusion over the nature of prices. The concept of "price ratio" could, according to Lange, mean not only the exchange-ratio between two commodities in the market, but also, more generally, the "terms on which alternatives are offered"; and he contended that only price ratios in this more generalized sense are indispensable for achieving a rational allocation of resources. In a centrally planned socialist economy, there would be no price ratios in the narrower sense among capital goods, but this would not, he said, preclude the existence of such ratios in the more general sense, because central planners and administrators would have access to the same knowledge of production-functions that is available to capitalist entrepreneurs, and could thus manage to make rational economic decisions.

Lange regarded Hayek and Robbins as offering a more sophisticated and stronger version (than von Mises had come up with) of the argument against the feasibility of socialist economic calculation. He interpreted them as conceding the *theoretical* possibility of a rational allocation of resources in a socialist economy, but as arguing that such an allocation was not realizable *in practice* under socialism. (Hayek thought that any central planning board would have to solve many thousands of equations in order to allocate resources; Robbins said it would entail millions of equations.[8]) Lange acknowledged that capitalist economies are able to solve the problem of allocating resources rationally via trial-and-error processes (Leon Walras had called them *tâtonnements*) in which capitalists adjust prices up or down until markets clear, and that price changes will then act as signals to tell other capitalists whether to increase or decrease the production of given goods or services. He said that in a centrally planned socialist economy, the functions which are performed by the price system would have to be duplicated somehow by the central planners. He believed that they could do it by using a

7. Many economists have declined to focus on long-term prospects.

8. See Note 1 above.

trial-and-error procedure "to determine accounting-prices of capital goods and of productive resources in public ownership": the lanners would adjust prices up or down depending on whether shortages or surpluses had appeared. (They would, for instance, reduce the prices of overstocked elements.) In an essay published in 1936, Lange discussed various models which a socialist economy might conceivably follow, including some with full freedom for consumer-choices and occupational choices, as well as some where those kinds of freedom would be restricted or even eliminated. He tried to demonstrate that in all those cases, central planners could solve the problem of achieving (a) consistency of decisions and (b) efficiency in carrying them out, and could thus allocate resources rationally. He went on to make it clear that he did not advocate a socialist model in which bureaucrats suspend freedom of choice for consumers and workers in order to impose their own preference-scales on people. He said: "Mr. [Abba] Lerner has sufficiently shown the undemocratic character of such a system and its incompatibility with the ideals of the socialist movement." A year later he pointed out that

> "As [Cambridge] Professor [A.C.] Pigou has shown, there is frequently a divergence between the private cost borne by an entrepreneur and the social cost of production. In the cost account of the private entrepreneur, only those items enter for which he has to pay a [monetary] price [to someone else], while such items as the maintenance of the unemployed created when he discharges workers, the provision for the victims of occupational diseases and industrial accidents, etc., do not enter.... [Under capitalism, certain important matters, such as the]life, security, and health of the workers, are sacrificed without being accounted for as a cost of production. A socialist economy would be able to put all the alternatives into its [in-kind] economic accounting. …By doing so it would avoid much of the social waste connected with private enterprise. As Professor Pigou has shown, much of this waste can be removed by proper legislation, taxation, and bounties within the framework of the present economic system; but a socialist economy can do it with greater thoroughness."

Hayek's rejoinder (1940) began with the argument (which he said Pareto had hinted at) that socialist economic planning would be unfeasible because the planners would have to solve too many simultaneous equations; then he turned to Lange and his allies (mentioning Dickinson) and, after berating them for allegedly not admitting that their proposals for socialist economic planning differed from previous ones which socialists and critics of socialism had been discussing, expressed doubt as to the efficiency of having a central authority adjust prices by trial and error. He was convinced that no central authority could reset prices in a timely manner; at best it would be, he said, much slower than market forces at adjusting them in relation to supply and demand. He added that people like Lange and Dickinson, overly concerned with the issue of whether or not a socialist economy could duplicate the results achieved by a market economy under conditions of perfect competition, ignored the fact that capital goods in heavy industry (buildings, ships, machinery etc.) are usually produced to meet special contracts rather than for open markets; vendors might compete to win the contracts, but seldom under conditions resembling perfect competition as envisioned by neoclassical economists. No central planning authority could, he said, be relied upon to set prices properly in such peculiar situations.

Lange acknowledged promptly in a letter to Hayek that this article made some important points. He saw Hayek as having shifted considerations of the socialist-calculation problem from a "static" to a "dynamic" stand- point. Lange said that even though sensible prices could in theory be determined by trial and error in the absence of a market, in practice he favored the determination of prices by markets wherever this was feasible – which for him meant wherever there were sufficiently large numbers of both purchasers and sellers – but that prices should be set by public agencies in those sectors of the economy where the numbers of sellers or purchasers are low. He held that something analogous happens under capitalism, except that there it is monopolies which do the price-fixing rather than agencies acting in behalf of public interest.

Hayek responded in 1945 in a paper, "The Use of Knowledge in Society," which is nowadays remembered less for its repeated arguments against Lange than for the one about diffused knowledge which we have cited int he main part of this essay. Hayek held that the trial-and-error method of planning proposed by Lange could never produce a rational allocation of resources because there could never be any way for national planners

to gather together enough valid information. In The Road to Serfdom he argued that one reason why, if the Labour Party were to win the election of 1945, life in Great Britain would amount to serfdom, was that it is

> "…impossible to assume control over all the productive resources without also deciding for whom and by whom they are to be used. Although under this so-called 'competitive socialism' the planning by the central authority would take somewhat more roundabout forms, its effects would not be fundamentally different, and the element of competition would be little more than a sham."

In the 1960s, Lange argued, in an essay entitled "The Computer and the Market", that recent technological developments made it possible to solve in relatively short periods of time the large sets of equations theoretically involved in certain aspects of rational central planning. This did not change his basic view that planners would always have to correct their plans by the trial and error. He said that some economic processes are so complicated that it would still be impossible to construct good computerized models of them, and he observed that markets were already being used in socialist economies for the distribution of consumer goods; yet he argued that computers give faster answers than markets do, and that market-price changes cause different social groups to experience either increases or decreases in their incomes (with results that would be problematic in a socialist economy where there is supposed to be a policy of evening out the incomes) and indeed that markets sometimes fail to provide iterative solutions to the equations – that is, they do not always converge to equilibrium, there may instead be "cobweb-cycles" (inventory- or other reinvestment-cycles) as well as more general business cycles. He felt that while computers could be used for making prognostications, (a) it would be unwise to try to replace markets altogether in regard to short-term decisions; economic planners could instead use sophisticated computer models to make forecasts which would then be verified against market data; whereas (b) markets are not very useful for long-term economic planning since they work by treating the accounting problem as a static issue. He was alert to the fact that prices reflect recent conditions but do not provide systematic information as to the possible effects of investment changes, of changes in technical conditions for production, and of the creation of new wants. Such shortcomings in the informative value of market prices were, in his opinion, present under capitalism as well as under socialism. Hayek never replied to these arguments.

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A recent (2019) book that has attempted to address some of these issues (partly by pointing back to some of Lange's and Neurath's insights) is *The People's Republic of Walmart*, by Leigh Phillips and Michal Rozworski. They point out that mega-corporations like Walmart and Amazon are, in effect, able to plan and administer vast privately-owned economies, and they stress the role of modern computer technology in enabling such corporations to do this. Phillips and Rozworski draw also upon the insights of Ronald Coase, who, in his 1937 paper, "The Nature of the Firm", introduced the important concept of "transaction costs". He said that

> "The main reason why it is profitable to establish a firm would seem to be that there is a cost of using the price mechanism. The most obvious cost of 'organising' production through the price mechanism is that of discovering what the relevant prices are. This cost may be reduced but it will not be eliminated by the emergence of specialists who will sell this information. The costs of negotiating and concluding a separate contract for each exchange transaction which takes place on a market must also be taken into account. Again, in certain markets, e.g., produce-exchanges, a technique is devised for minimising these contract costs; but they are not eliminated. It is true that contracts are not eliminated when there is a firm but they are greatly reduced."

Coase had noticed that reliance upon the price system and on markets for organizing economic activity has its own sets of costs associated with it which people may well try to minimize, and he noted that one of the chief methods for doing this has been through the creation of firms in which economic activity is organized internally without necessarily relying on the price system. When he wrote that paper, he was still a socialist (although he would later become a Chicago-School-style conservative). He was a close friend of the socialist economist, Abba Lerner, and like Lerner, was very interested in the Socialist-Calculation Debate and in such

questions as why the USSR's centrally planned national economy was as successful as it was (in those days) even though neoclassical economic theory would always insist that it must never meet with success. Many years later (i.e. in 1991) Coase described as follows that budding theoretical interest of his back in 1937:

> "I decided to study vertical and lateral integration of industry in the United States. [Prof. Arnold] Plant had described in his lectures the different ways in which various industries were organised, but we seemed to lack any theory which would explain these differences. I set out to find it. There was also another puzzle which, in my mind, needed to be solved and which seemed to be related to my main project. The view of the pricing system as a coordinating mechanism was clearly right but there were aspects of the argument which troubled me. Plant was opposed to all schemes, then very fashionable during the Great Depression, for the co-ordination of industrial production by some form of planning. Competition, according to Plant, acting through a system of prices, would do all the coordination necessary. And yet we had a factor of production, management, whose function was to co-ordinate. Why was it needed if the pricing system provided all the coordination necessary? The same problem presented itself to me at that time in another guise. The Russian Revolution had taken place only fourteen years earlier. We knew then very little about how planning would actually be carried out in a communist system. Lenin had said that the economic system in Russia would be run as one big factory. However, many economists in the West maintained that this was an impossibility. And yet there were factories in the West and some of them were extremely large. How did one reconcile the views expressed by economists on the role of the pricing system and the impossibility of successful central economic planning with the existence of management and of these apparently planned societies, firms, operating within our own economy?"

Paul Cockshott and Allin Cottrell, who have written on technological aspects of these issues in a number of late-20th- and early 21st-century writings, have said, in an article about Hayek's arguments, that

> "[C]ontrary to Hayek's claims, the amount of information that would have to be transmitted in a planned system is substantially lower than for a market system. The centralised [government's] gathering of [economic] information is less onerous [to society] than the commercial correspondence required by the market."[9]

According to a report published in 2023 by an Australian think-tank, "China has built the foundations to position itself as the world's leading science and technology superpower, by establishing a sometimes stunning lead in high-impact research across the majority of critical and emerging technology domains", and "China's lead is the product of deliberate design and long-term policy planning."[10]

It is, however, not our task in this essay to offer predictions.

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9. Cottrell and Cockshott, "Information and Economics: A Critique of Hayek" (1994; see www.dcs.gla.ac.uk/~wpc/reports/hayek/hayek.pdf), p.16. In their book *Towards a New Socialism* (1993; the text is available online at: http://users.wfu.edu/cottrell/socialism_book/index.html), they proposed that money ought to be replaced by tokens indicating how much labor has been done (on average) in order to create and deliver each particular kind of consumable item produced by humans, and that modern societies ought to voluntarily reorganize themselves into relatively small "communes" while modern-type government "dissolve[s] into a neo-Athenian democracy". (Political governance in the ancient Athenian type of democracy was done via a complicated (and evolving) system whereby most of the government's office holders were unpaid volunteers (from among the citizens, who were a minority of the population) chosen by lot to render such service for non-renewable one-year terms; see https://en.wikipedia.org/wiki/Athenian_democracy.) (Our quick sketch, in this footnote, of what is proposed in the book is based on remarks in the second and third paragraphs of a review of it which is accessible free of charge at https://cdn.mises.org/qjae7_1_6.pdf. Cockshott's response to the review is accessible at https://web.archive.org/web/20171118112245/http://reality.gn.apc.org/econ/replytobrewster.pdf.)
   In regard to replacing money with estimated labor-time as the basis for evaluating production costs, Cockshott and Coltrell said (on page 45 of the book) that "We could[,] in principle [i.e. in our theorizing, propose to] measure costs [of economic production] in terms of any widely used resource [rather than in terms of monetary costs reckoned in terms of the national currency]. In an industrial economy we might reasonably price goods in terms of the energy that went into their production. If society faced overriding constraints upon the amount of energy that it could use, perhaps for environmental reasons, then this might be a good way to price things. We [instead] advocate [in this book] using labor time as the basic unit of account because we think that society is about people, and[,] for the moment at least, how people spend their lives remains more important than any one natural resource."

10. See www.aspi.org.au/report/critical-technology-tracker.

"Physicalism: The Philosophy of the Viennese Circle" in the journal *The Monist, Volume 41, Issue 4, 1 October 1931, accessible via https://doi.org/10.5840/monist19314147

habilitierte Neurath sich 1917 in Politischer Ökonomie an der Universität Heidelberg über Die Kriegswirtschaftslehre und ihre Bedeutung für die Zukunft

Durch die Kriegswirtschaft zur Naturalwirtschaft. Callwey, München 1919.

gründete Neurath 1920 den Österreichischen Verband für Siedlungs- und Kleingartenwesen und wurde zu dessen Generalsekretär (s. Siedlungspolitik)